

Teacher's Guide

This module is about a particular effect of the frequency which is the stroboscopic effect.

The frequency of a periodic phenomenon is simply defined as the number of times the phenomenon repeats itself in a unit time. For example, the number of times a car wheel rotates in one minute [assuming constant velocity] would be the frequency of rotation defined by: [number] of rounds or rotations per minute.

Low frequency phenomena, approximately, less than 16 Hz, which means 16 repetitions per second, can usually be observed clearly by the eye. High frequency phenomena, let's say of more than 25 Hz, are difficult to catch for the human eye.

This is the principle of movie-making, consisting of sending frames at a high cadence, meaning high frequency, so that the eye sees the still images as fluid and continuous because the vision of an image persists on the retina from 1/50 to 1/25 of a second.

See for further details:

http://en.wikipedia.org/wiki/Persistence_of_vision
or <http://www.acm.org/crossroads/xrds3-4/ellen.html> and
http://facweb.cs.depaul.edu/sgrais/animation_basics.htm

On the other hand, high frequency phenomena could be observed by freezing the fast moving or rotating phenomenon using a device called a stroboscope.

A stroboscope is a flashing device, emitting a low or high number of flashes per second. When the adjusted frequency of the stroboscope matches the frequency of the periodic phenomenon, the phenomenon or object is "frozen in some position and details can be seen although the object is still rotating at a high frequency. If we wish to determine the speed of rotation of the turning object, we must find the maximum frequency of the stroboscope for which the object appears still.

At the end of this module, one learns that although the light, of a lamp, seems ON continuously, it is actually blinking (ON/OFF) but as the frequency of that light is too high compared with the frequency that the eye can distinguish, the light appears as always ON. One can also test the validity of this conclusion by constructing or using the toys suggested during the module. The most intriguing part, one can learn, is the last part, where the blades of the fan are virtually "frozen" and the word written on the blade can be read. The stroboscopic effect might be dangerous in that it can cause *photo-induced epilepsy* and that by freezing the motion, an object appears still although it is still moving or rotating and that engenders harm if one gets too close to that object, especially, sharp objects like an electric saw or a ceiling fan.